

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of

)	
Modification of Parts 2 and 15 of the)
Commission's Rules for unlicensed devices)
and equipment approval)

ET Docket No. 03-201

Reply Comments of Navini Networks, Inc.

Navini Networks, Inc. ("Navini"), by its counsel, hereby submits these Reply Comments in the above-captioned proceeding. In reviewing the 58 comments submitted, Navini notes that 22 parties specifically addressed the advanced antenna proposals and virtually all were in support of making these new technologies available to the public.¹ In terms of adaptive beamforming (or phased array antenna) technology, with the inherent ability to serve multiple simultaneous users in a spectrally efficient manner, the record strongly favors continuing with the current regulatory approach. Accordingly, Navini urges the Commission not to deviate from the rule interpretations, which have allowed this unique broadband technology to develop and prosper. Thus, any Part 15 rule amendments for phased array antenna systems must maintain policies that include the following:

- Impose no limits on aggregate beamwidth
- Impose no limits on EIRP per beam
- Impose no power reductions for overlapping beams
- Provide an aggregate (multiple beam) power allowance of up to 9dB
- Permit coherence loss to be applied to system power rather than directional gain

¹ *But see*, Pegasus Technologies that opposes the use of advanced antenna technologies in the 2.45 GHz band.

- Maintain the current spectral power density levels in the 2.45GHz band
- Permit average measurements for 2.45GHz digital modulation devices

Summary of Comments

Several comments favored a 120° (or similar) beamwidth limit on advanced antenna systems; however, none of the comments explained how such a limit could feasibly be accomplished in a multiple beamforming environment.² Others firmly opposed limits on beamwidth, even for fixed-beam sectorized systems.³ A few commenters addressed the subject of EIRP limits per beam⁴ and reductions in power for beam overlaps;⁵ however, there appeared to be no consensus on either issue. Once more, none of the comments explained how such limits could work in a multi-beamforming environment. On the issue of harmonization with the U-NII bands, the comments were unanimously in favor of allowing average measurements for digital modulation devices, although no commenter supported harmonization on the U-NII spectral power density limits.⁶ Finally, it appears that only Navini addressed the issues of aggregate transmitter power and coherence loss for beamforming systems, arguing in both cases for the current regulatory policies to remain in effect.⁷

Discussion

It is clear from the record that there is widespread industry support for Part 15 rule amendments designed to facilitate new developments and uses of advanced antenna technologies. The Commission's proposals will further the goal of making its current policies permanent, but several refinements are still needed to reflect the important differences that exist among the various technologies. To illustrate, when dealing with

² See Nortel Comments page 6; Alvarion Comments page 3; Wi-Fi Alliance Comments page 2; YDI Wireless Comments page 2; CEA Comments page 3; Information Industry Technology Council Comments page 4.

³ See Intel Comments page 2; Bandspeed Comments page 4; IEEE Comments page 3.

⁴ See Nortel page 7; Bandspeed page 6; Arraycomm Comments page 5; Alvarion page 5.

⁵ See Nortel page 7; Bandspeed page 6-8; Sirius Comments page 3.

⁶ See Tropos Comments page 2 suggesting the U-NII limits actually be harmonized on the Section 15.247 limits.

⁷ See Navini Comments pages 6 and 10.

interference issues at the beam level, it should be apparent to the Commission that it would be regulatory folly to presume “one size fits all.” The comments in this proceeding resoundingly demonstrate that different antenna technologies call for different rules.

Advanced antenna technologies fall into three basic categories: (1) sectorized systems with a single fixed beam pattern; (2) switched beam systems with a limited number of fixed beam patterns; and (3) adaptive systems with an infinite number of non-fixed patterns. From these differences it would seem that the Commission’s proposal to limit beamwidths to 120° is incompatible with adaptive systems that form dozens of simultaneous beams. As Navini’s comments explain, adaptive beamforming is designed to share power dynamically among all users; hence, aggregate interference “coverage area” always stays the same.⁸ Even a beamwidth limit on a per channel (or per frequency) basis, as some have suggested,⁹ makes no sense in the context of adaptive beamforming because simultaneous beams are formed continuously on individual channels. Thus, any restrictions on beamwidth will arbitrarily impact adaptive beamforming systems and place them at a competitive disadvantage in the market.

Navini appreciates the Commission’s concern that its rules not be abused by point-to-point antenna designs that appear identical to omni-directional systems. However, Navini suggests an alternative rule that establishes a limit only as to beams that transmit the “same information.” If more than 50 percent of the information transmitted on two or more beams at any point in time is the same, it can be assumed that the transmission is not point-to-point. In such case, the aggregate beamwidth could be limited to 120°. This compromise addresses the Commission’s core concern and the concerns raised in several comments¹⁰ of harmful interference caused by antenna designs that are not true point-to-point systems. Navini urges this alternative be considered as a preferred solution as it

⁸ Navini comments page 3-4.

⁹ See Alvarion page 3.

¹⁰ The Wi-Fi Alliance supports the 120° limit along with an individual beam half-power width of 5° but provides no justification for such limit, undoubtedly because such a limit is technically impractical as well as commercially infeasible.

treats all advanced antenna technologies (sectorized, switched beam and adaptive) equally under the rules.

A similar issue involves beam overlaps and whether these should trigger a reduction in power. Here again, adaptive beamforming would be disadvantaged by such a rule because of the dynamic nature in which beams are formed. Sectorized and switched beam systems form one beam at a time; thus, beam overlaps can be controlled through careful deployment of multiple systems. Adaptive beamforming, on the other hand, creates multiple simultaneous beams (in a single system) on a dynamic basis which are dependent on the users' locations (and can sometimes be mobile). For these systems, beam overlaps are not controllable by the system operator. Moreover, because system power is always shared among beamformed users, any rule that also requires a reduction for overlaps becomes punitive in nature. Indeed, such a rule simply could not be implemented without destroying the essential design of this technology.

The Commission has said repeatedly that its proposed rules are intended to accommodate phased array antenna systems that have previously been allowed by interpretation of the rules. If that is to be the case, the Commission should adhere to the 9dB aggregate power allowance that it has previously allowed for eight element antenna arrays like Navini's. Further, the Commission should permit coherence loss to be offset against antenna power reductions rather than antenna gain. Navini was the only party to address these issues in its comments and appears to be the only entity whose technology will be impacted by such rules. Because nothing on the record supports a deviation from the Commission's current rule interpretations, these policies should be followed to accommodate Navini's technology.

Finally, it is noted that only Microsoft supports a spectrum sharing etiquette for advanced antenna technologies, with all other parties firmly opposing the issue. Navini agrees with the opponents of a spectrum etiquette as it would be extremely difficult, if not impossible, to implement in the context of adaptive beamforming. In any event, the record developed in this proceeding is clearly insufficient to support the adoption of

sharing rules at this time. Accordingly, Navini suggests that these matters be left to the work of the industry standards groups, which are better equipped to commit the resources necessary to deal with such controversial subjects.¹¹

Conclusion

Navini commends the Commission for its leadership role in promoting the development of advanced antenna technologies in the unlicensed bands. The rules proposed in this proceeding will codify the informal policies and rule interpretations that have made the Navini beamforming technology available to the public. However, Navini cautions against a “one size fits all” approach for systems which fall under the broad heading of “advanced antenna technologies.” Beamforming systems are unique in their ability to dynamically form multiple simultaneous beams without requiring additional power. As Navini has demonstrated, these systems cannot feasibly tolerate arbitrary restrictions on beamwidth or power reductions for beam overlap. To ensure that Navini’s current technology is fully accommodated by the new rules, the Commission is urged not to adopt beamwidth or EIRP limits or overlap reductions. The Commission is urged to allow an aggregate transmitter power of 9dB (based on Navini’s eight element array); to permit coherence loss to offset antenna power reductions rather than antenna gain; and to keep the spectral power density limits in the 2.45GHz band. Finally, Navini supports the Commission’s proposal to harmonize the average measurement procedures for digital modulation devices in the 2.45GHz band.

¹¹ Sirius proposes an out-of-band emission mask to protect DARS that goes beyond the scope of this proceeding. Sirius Comments page 6. In any event, Navini vigorously opposes the proposed mask for DARS bands, as it would add prohibitive filtering costs on both base stations and CPE. The Part 15 Organization proposes a maximum 15° beamwidth, horizontally and vertically, for CPE. Part 15 Organization Comments page 4. Again, this goes beyond the scope of the current proceeding; however, it is an entirely impractical requirement for customer installed CPE and, therefore, opposed by Navini.

Respectfully Submitted

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